133236.PM.PO/D1/01

06.04 - 11/1/2000-2592

Pre-Final

No Further Action Decision Document Site 68 MCB, Camp Lejeune, North Carolina

Prepared For

Department of the Navy

Atlantic Division
Naval Facilities Engineering Command

Norfolk, Virginia

Contract No. N62470-95-D-6007
CTO-0120

November, 2000

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QC Review Page

No Action Decision Document

Site 68 MCB Camp Lejeune

Contract Task Order Number – 0120
Contract Number N62470-95-D6007
Navy CLEAN II Program

Prepared by

Baker Environmental

November 2000

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
Baker	Baker Environmental, Inc.
BEHP	bis(2-ethylhexyl)phthalate
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CLP	Contract Laboratory Program
COC	Contaminant of Concern
DD	Decision Document
DON	Department of the Navy
ER-L	Effects Range - Low
ER-M	Effects Range - Medium
ESE	Environmental Science and Engineering, Inc.
FFA	Federal Facilities Agreement
FS	Feasibility Study
HI	Hazard Index
HQ	Hazard Quotient
IRP	Installation Restoration Program
LANTDIV	Atlantic Division Naval Facilities Engineering Command
LUCIP	Land Use Control Implementation Plan
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NC DENR	North Carolina Department of Environment and Natural Resources
NCWQS	North Carolina Water Quality Standards
NEHC	National Environmental Health Center
NFA	No Further Action
NPL	National Priorities List
NFRAP	No Further Response Action Plan
PA	Preliminary Assessment
PCB	Polychlorinated Biphenyls
Pre-RI	Pre-Remedial Investigation

ACRONYMS AND ABBREVIATIONS

RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RA	Removal Action or Remedial Action
RBC	Risk-Based Concentrations
SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Society
VOC	Volatile Organic Compound

DECLARATION

SITE NAME AND LOCATION

Site 68
Rifle Range Dump
Marine Corps Base, Camp Lejeune, North Carolina

STATEMENT OF BASIS

This No Further Action (NFA) decision is based on the results of a Pre-Remedial Investigation (Pre-RI) Screening Study conducted at Site 68 in October 1995. The Pre-RI Screening Study included a review of previous investigations, surface water and sediment sampling, installation of groundwater monitoring wells, and associated soil and groundwater sampling.

DESCRIPTION OF THE SELECTED REMEDY

Based on the current conditions at Site 68, it has been determined that with the implementation of a Land Use Control Implementation Plan (LUCIP) no threat to public health exists. Therefore, no further action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), is warranted.

DECLARATION STATEMENT

This NFA Decision Document (DD) represents the selected action for Site 68, developed in accordance with CERCLA, as amended by SARA, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Because contaminant levels at the site have been determined to present no known significant threat to human health, it has been determined that no further action is protective of human health, attains Federal and state requirements that are applicable or relevant and appropriate, and is cost-effective. The statutory preference for treatment is not satisfied because treatment was not found to be necessary. Even though it has been determined through site-specific risk analysis that there are no potential human health risks at Site 68, land use and aquifer use will be controlled because some inorganics in site media exceed screening values, including Federal Maximum Contaminant Levels (MCLs) for groundwater. These land and aquifer use controls are presented in the LUCIP in Attachment A. These controls will be enforced until it is determined, through the five year review process, that no potential human health risks are posed by the inorganics.

_____ _____

Signature Date
Major General R. G. Richard
Commanding General
Marine Corps Base, Camp Lejeune

DECISION SUMMARY

1.0 INTRODUCTION

Marine Corps Base (MCB), Camp Lejeune was placed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List (NPL) on October 4, 1989 (54 Federal Register 41015, October 5, 1989). Subsequent to this listing, the United States Environmental Protection Agency (USEPA) Region IV; the North Carolina Department of Environment and Natural Resources (NC DENR); and the United States Department of the Navy (DON) entered into a Federal Facilities Agreement (FFA) on March 1, 1991 (effective date) for MCB, Camp Lejeune. The objectives of the FFA are:

- To ensure that the environmental impacts with past and present activities at MCB, Camp Lejeune are thoroughly investigated and appropriate CERCLA response actions are developed and implemented as necessary to protect the public health, welfare and the environment;

- To establish a procedural framework and schedule for developing, implementing and monitoring appropriate response actions at MCB, Camp Lejeune in accordance with CERCLA, the NCP, and USEPA policy relevant to remediation at MCB, Camp Lejeune; and

- To facilitate cooperation, exchange of information and participation of the parties in such action.

The Fiscal Year 2001 Site Management Plan for MCB, Camp Lejeune, the primary document referenced in the FFA, accounts for each of the sites at the Base and provides detailed strategic planning. Many of the sites listed in the FFA have been investigated through the completion of Remedial Investigation/Feasibility Studies (RI/FS). However, several sites, (Site 68 included) did not warrant a full scale RI/FS. As such, these sites were investigated by completing Pre-Remedial Investigation (Pre-RI) Screening Studies. The goal of these investigations was to determine if a full RI study was necessary or if a decision of no further action was appropriate.

This No Further Action (NFA) Decision Document (DD) supports no further action for Site 68. The purpose of this NFA DD is to summarize the existing data for the site and to describe the Marine Corps' rationale for no further action. Even though it has been determined through site-specific risk analysis that there are no potential human health risks at Site 68, land use and aquifer use will be controlled because some inorganics in site media exceed screening values including Federal MCLs for groundwater. These land and aquifer use controls are presented in the LUCIP in Attachment A. These controls will be enforced until it is determined, through the five year review process, that no potential human health risks are posed by the inorganics.

Decision documents of this type can fall into four categories. The category into which a site is placed is determined by the investigation(s) that have been conducted at the site. They are divided as follows: Category I - NFA decision is based on the results of a Preliminary Assessment (PA), a PA supplement, or an equivalent effort; Category II - NFA decision is based on the results of a Site Inspection (SI), a SI supplement, or an equivalent effort; Category III - NFA decision is based on the results of a Remedial Investigation (RI) and, if required, a Feasibility Study (FS), or an equivalent effort; Category IV - NFA decision is based on the completion of a removal action or remedial action (RA) (including interim actions), or an equivalent effort.

Site 68 is a Category II designation. The Pre-RI Screening Study was completed to determine if further investigations were warranted; this effort is equivalent to a SI. The Pre-RI Screening Study completed at Site 68 provides sufficient information about the history, nature of the site and subsequently verifies the lack of contamination. Therefore, a Category II - NFA DD is herein presented in accordance with all Category II requirements.

The objectives of this NFA DD for Site 68 are:

- To briefly describe the location, history and environmental setting of Site 68 and its relationship to MCB, Camp Lejeune;
- To describe the current status of the site based on the results of the related investigations; and
- To assess the potential risks to human health at the site.

Data from the Pre-RI Screening Study [Baker Environmental, Inc. (Baker), 1998] were used to derive and support no further action for Site 68. The Pre-RI Screening Study was initiated to detect and characterize potential impacts to human health, and to determine if the site required further investigative work. The investigation included a review of previous studies, soil sampling, permanent monitoring well installation, groundwater sampling, surface water sampling, sediment sampling, and a site survey.

1.1 Site Location and Description

To provide the reader with the entire framework of Site 68, the following subsections discuss site locations and descriptions for both MCB, Camp Lejeune and Site 68.

1.1.1 MCB, Camp Lejeune

MCB, Camp Lejeune is located on the coastal plain of North Carolina in Onslow County. The facility is bisected by the New River and encompasses approximately 236 square miles (of which approximately 40 square miles is water, made up by the New River and its tributaries). The New River flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. The southeastern border of MCB, Camp Lejeune is the Atlantic Ocean shoreline. The western and northeastern boundaries of the facility are U.S. Route 17 and State Route 24, respectively. The city of Jacksonville borders MCB, Camp Lejeune to the north.

Construction of MCB, Camp Lejeune began in April 1941 at the Hadnot Point Industrial Area, where major functions of the base are centered today. The facility was designed to be the "World's Most Complete Amphibious Training Base." The MCB, Camp Lejeune complex consists of six geographical and operational locations under the jurisdiction of the Base Command. These areas include Camp Geiger, Montford Point (which includes Camp Johnson), Courthouse Bay, Mainside, the Rifle Range Area and the Greater Sandy Run Area. Marine Corps Air Station (MCAS) New River is operationally under the control of MCAS Cherry Point. However, MCB, Camp Lejeune is responsible for the facilities and environmental management of MCAS New River.

Site 68 is located near the Rifle Range Area. Stone Bay Rifle Range was constructed in 1941 and was used for training Marine Corps Personnel.

1.1.2 Site 68

As shown on Figure 1-1, Site 68 is located near the Rifle Range Area in the southwest portion of the MCB, Camp Lejeune.

Figures 1-2 and 1-3 show the boundary and features of the surrounding area. Site 68 is located to the west of Range Road, approximately 200 feet west of the Rifle Range Water Treatment Plant, and about 800 feet east of Stone Creek. The entire suspected disposal area is reported to be less than five acres in size.

Site 68 is accessed from the east, along the northern edge of the Rifle Range parking area. An improved dirt road leads into the center of the suspected disposal area. With the exception of the main road (Loop Road) which loops through the center of the site, the majority of the site is densely wooded. Evidence of clearing and ground disturbance was noted to the south and west of Loop Road on historical aerial photographs of the area. During the 1993 site visit, excavated trenches which contained construction debris and road asphalt, were observed west of Loop Road.

Currently, Loop Road is used as a fitness trail with exercise stations along the way. Evidence of military personnel activity and maneuvers are present throughout the site.

The flat topography of MCB, Camp Lejeune is typical of seaward portions of the North Carolina coastal plain. Elevations on the base vary from sea level to 72 feet above mean sea level (msl); however, most of the base is between 20 and 40 feet above msl. At Site 68, the site topography is variable with elevations ranging from 50 feet msl to the east to 5 feet msl to the northwest. Soil in this area is primarily sandy and favors rapid infiltration of surface precipitation. There is evidence that surface water runoff does occur in a northwest direction toward Stone Creek [Environmental Science and Engineering, Inc. (ESE),1990].

1.2 Site History and Enforcement Activities

Site 68 was reportedly used as a disposal facility for a period of 30 years from 1942 to 1973. Although not documented, an estimated 2,000 gallons of waste solvents were reportedly disposed in this area. In addition, it has been reported that approximately 100,000 cubic yards of various types of material (i.e., garbage, building debris and waste treatment sludge) were also disposed here. The suspected disposal area, less than 5-acres in size, lies within a 30 to 40-acre area. Signs of activity (i.e. deforested areas), were identified in historical aerial photographs (ESE, 1990).

Two investigations have been conducted at Site 68. They are detailed in the following subsections. No enforcement activities have occurred at Site 68.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) states that sites which the USEPA determines to need no additional evaluation are given a "No Further Response Action Plan (NFRAP)" designation within the CERCLA Information System (CERCLIS). Through this designation, no supplemental investigation or remediation work will be performed at the site unless new information is presented indicating that the initial decision was not appropriate. This NFA DD presents the pertinent information that supports the conclusion that Site 68 poses little or no potential threat to human health.

1.2.1 Investigative Activities

The conditions at Site 68 have been evaluated through several separate investigative activities. The following subsections provide a summary of the previous studies completed at the site along with the results of the Pre-RI Screening Study.

1.2.1.1 Previous Investigations

In 1984, shallow monitoring wells 68-GW01, 68-GW02, and 68-GW03 were installed for the purpose of groundwater sampling (Figure 1-2) around the Rifle Range Dump. The monitoring wells were comprised of 15 feet of screen and set at depths of 25 feet below ground surface (bgs). Groundwater samples were collected from the three newly installed monitoring wells and the existing supply wells, RR-45 and RR-97. The groundwater samples were analyzed for volatile organic compounds (VOCs). No detections of VOCs were reported in the groundwater sample set. No soil samples were collected during the investigation.

In 1986, the three monitoring wells were resampled and analyzed for VOCs. Again, no VOCs were detected in the groundwater samples collected from these wells.

1.2.1.2 Pre-RI Screening Study

The field work for a Pre-RI Screening Study was completed by Baker in October 1995 with additional groundwater sampling in March 1998. The final report completed in November 1998. The investigation included researching the previous studies and completing additional investigative tasks. The field activities included surface and subsurface soil sampling, groundwater sampling, surface water sampling, and sediment sampling.

Surface soil, subsurface soil, groundwater, surface water and sediment samples were collected at Site 68. The soil samples were analyzed for Target Compound List (TCL) organics and Target Analyte List (TAL) Metals. Groundwater, surface water, and sediment samples were analyzed for the same parameters. In addition, water quality parameters including temperature, pH, dissolved oxygen, conductivity, salinity, and turbidity were recorded for surface water sample locations.

Tables 1-1 through 1-7 contain criteria against which the sample results were compared by media. These criteria included Residential Contaminant of Concern (COC) Screening Values based on the USEPA Risk Based Concentration (RBC) values, USEPA Soil Screening Levels for transfer from soil to groundwater, and twice the average base specific background concentrations for inorganic analytes. RBCs are promulgated by the USEPA Region III as a tool to determine potential risk to human health from contaminants in soil and groundwater.

Surface Soil

A total of 24 surface soil samples were obtained at Site 68 and submitted for TCL organic and TAL metal analyses. As indicated on Table 1-1, only one VOC (acetone) was detected in three samples. No other VOCs were detected in surface soil samples at Site 68. None of the detections exceeded respective screening standards.

Detections of three semivolatile organic compounds (SVOCs) were limited to six of the surface soil samples. Phenol was detected in one sample while di-n-butylphthalate and bis(2-ethylhexyl)phthalate (BEHP) was detected in four samples. The maximum concentration of BEHP was detected at boring

location 68-SB09. None of the SVOCs exceeded their respective screening standards as noted on Table 1-1.

Pesticide compounds were detected in 22 of the 24 surface soil samples. The pesticide concentrations appear to be widely scattered across the site. The pesticides 4,4'-DDE and 4,4'-DDT were the most common pesticides detected. Pesticide concentrations ranged from 170J µg/kg of 4,4'-DDE to 2.3J µg/kg of 4,4'-DDT. Methoxychlor was detected at an estimated concentration of 18J µg/kg.

One surface soil sample had a positive detection of a polychlorinated biphenyl (PCB) compound. Aroclor-1260 was detected at a concentration of 290 µg/kg at soil boring location 68-SB05. This concentration did not exceed the residential COC screening value of 320 µg/kg. No other PCB compounds were detected among any of the 24 surface soil samples obtained from Site 68.

Twenty-one of 23 TAL metals were detected among the 24 surface soil samples obtained from Site 68 (silver and thallium were not detected). Table 1-2 provides a summary of the metals detected within soil samples from Site 68. Eight metals including aluminum, barium, beryllium, copper, lead, manganese, nickel, and zinc were detected at concentrations greater than twice the average base-specific (i.e., MCB, Camp Lejeune) background levels (refer to Table 1-2 for twice the average base specific background concentrations). Inorganic analytes which exceeded residential COC screening values included antimony, arsenic, iron, and manganese. Those analytes which exceeded the USEPA Soil Screening Levels were iron, manganese, mercury, and selenium.

Subsurface Soil

A total of 25 subsurface (i.e., greater than one-foot bgs) soil samples were obtained at Site 68 and submitted for TCL organic and TAL metal analyses. Three volatile compounds were detected in subsurface soil samples (refer to Table 1-3). None of the detections of acetone, carbon disulfide, or 2-butanone exceeded residential COC screening values or the USEPA Soil Screening Levels.

Two SVOCs, pyrene and bis(2-ethylhexyl)phthalate, were detected at concentrations below their corresponding residential COC screening values and USEPA Soil Screening Levels.

Two other organic compounds were detected in the subsurface soil samples at Site 68, one pesticide and one PCB. The pesticide compound, 4,4'-DDT was detected in one of the 25 subsurface soil samples (68-SB17 from 11 to 13 feet) obtained from Site 68 while the PCB, aroclor-1260, was detected at three of the 25 locations (68-SB05 [15 to 17 feet], 68-SB15 [5 to 7 feet], and 68-SB17 [11 to 13 feet]). 4,4-DDT did not exceed the corresponding COC screening value or the USEPA Soil Screening Level. Soil Screening Levels for Aroclor-1260 do not exist.

Nineteen of the 23 TAL metals were detected among the 25 subsurface soil samples collected at Site 68. As shown on Table 1-4 only selenium was detected at a level below twice the average base specific background concentrations. Those analytes above residential COC screening values were aluminum, arsenic, iron, and manganese. While analytes detected in excess of the USEPA Soil Screening Levels were iron, manganese, and selenium.

Groundwater

The groundwater investigation at Site 68 entailed the collection of samples from three existing wells (68-GW01, 68-GW02, and 68-GW03) and six newly installed wells (68-GW01DW, 68-GW04, 68-GW04DW, 68-GW05DW, 68-GW06, and 68-GW06DW). The groundwater quality at Site 68 was evaluated by sampling both the upper portion of the surficial aquifer and below the Castle Hayne confining unit which was present over most of the site. Samples from the upper portion of the surficial aquifer were collected from 68-GW01, 68-GW02, 68-GW03, 68-GW04, and 68-GW06. Samples from the upper portion of the Castle Hayne aquifer were collected from 68-GW01DW, 68-GW04DW, 68-GW05DW, and 68-GW06DW.

Two rounds of groundwater samples were collected at Site 68. The first round of samples were obtained in January 1996 and analyzed for full TCL organics, TAL metals using contract laboratory program (CLP) protocols. Based upon the results of the draft Pre-RI Screening Study, a second round of groundwater sampling was conducted in March 1998. During this sampling event, samples were only analyzed for TAL inorganics. Analytical results from the groundwater investigation at Site 68 are provided in the following paragraphs. A positive detection summary of organic compounds and metals are provided in Table 1-5.

Only two VOCs were detected as part of the organic analyses of groundwater. Carbon disulfide was detected at shallow monitoring wells 68-GW06 and 68-GW04, both at concentrations of 4J µg/L. The compound 2-hexanone was detected at deep monitoring well 68-GW04DW at a concentration of 6J µg/L. There were no other organic compounds detected in the groundwater at Site 68.

SVOCs, PCB, and pesticide compounds were not detected in any of the groundwater samples collected from Site 68.

TAL metals were detected in each of the monitoring wells at Site 68. Twenty-two of the 23 TAL total metals were detected within at least one groundwater sample at Site 68 (silver was not detected). Of the positive detections, aluminum, antimony, iron, and manganese exceeded its respective North Carolina Water Quality Standards (NC WQS) or Federal Maximum Contaminant Levels (MCLs). Tapwater COC screening values were exceeded by antimony, arsenic, cadmium, iron, manganese, and thallium; while iron and manganese exceeded USEPA Soil Screening Levels.

Surface Water

A total of ten surface water samples were collected at Site 68. Five of the surface water samples were collected from Stone Creek and five samples were collected from an unnamed tributary which flows north into Stone Creek. The samples were collected from the segments of the streams which border the site from the northeast to the southwest. Each surface water sample was analyzed for full TCL organics and TAL inorganics using CLP protocol.

Analytical results from the surface water investigation are presented below as well as in Table 1-6. The screening values for the surface water samples were based upon NC WQS and USEPA Region IV Water Quality Standards.

Of the organic analyses, only one SVOC was detected in the surface water samples. Di-n-butylphthalate was detected at an estimated concentration of 1J µg/L at surface water sample station 68-SW01 located approximately southwest of the site in Stone Creek. This concentration is well below the respective screening standard of 2,700 µg/L. No other organic compounds were detected among the 10 surface water samples.

Thirteen of the 23 TAL total metals were positively detected among the surface water samples (antimony, beryllium, chromium, cobalt, copper, nickel, silver, and thallium were not detected). None of the detections of inorganic analytes in the surface water samples exceeded their respective screening standard.

Sediment

Sediment samples were collected from the same stations as the surface water samples. A total of ten samples were collected: five from Stone Creek and five from the unnamed tributary which flows north into Stone Creek. The sediment samples were obtained from zero to six inches into the sediment. Each of the ten sediment samples were analyzed for full TCL organics and TAL inorganics using CLP protocol.

Analytical results from the sediment investigation are provided in the following paragraphs and included on Table 1-7. Volatile and PCB compounds were not detected in any of the ten sediment samples.

SVOCs were detected in three of the ten sediment samples. At station 68-SD03, only one SVOC was detected, 250J µg/kg BEHP. Benzo(a)pyrene was detected at a concentration of 380 µg/kg at sampling station 68-SD05. The majority of SVOCs were detected at sampling point 68-SD07. The detections ranged from 420J µg/kg of fluoranthene to 62J µg/kg of anthracene. None of the detections exceeded the associated screening standards.

The pesticides 4,4'-DDD and 4,4'-DDE were detected in each of the ten sediment samples with the exception of sample point 68-SD02. 4,4'-DDT was detected in each of the sampling points with the exception of 68-SD01 and 68-SD04. Two other pesticide compounds, alpha-chlordane and gamma-chlordane, were detected at sample station 68-SD06 at concentrations of 13J µg/kg and 14NJ µg/kg. 4,4'-DDT detections ranged from 6.3 µg/kg to the maximum concentration at 4,500 µg/kg. The maximum 4,4'-DDT detection was detected in the sample obtained from station 68-SD07. The pesticide 4,4'-DDE was detected at concentrations ranging from 6.7 µg/kg at station 68-SD06 to 550 µg/kg at 68-SD10. 4,4'-DDD detections ranged from 2.5J µg/kg at station 68-SD03 to 2,900 µg/kg at station 68-SD03.

Each of the pesticide compounds were detected above their respective screening standards. Alpha-chlordane and gamma-chlordane were only detected in the tributary to Stone Creek to the east of the site. These contaminants were not detected in Stone Creek sediments. 4,4'-DDT, 4,4'-DDD and 4,4'-DDE were found in Stone Creek and tributary (to the east) sediments. The maximum 4,4'-DDD concentration occurs in the portions of Stone Creek that is to the west of the site. The maximum 4,4'-DDE and 4,4'-DDT concentrations occur in the tributary to the east of the site. There is an increasing trend of 4,4'-DDE, 4,4'-DDD and 4,4'-DDT concentrations (from the upstream direction) in the tributary to the east of the site. The pesticide concentrations in sediment to the west of the site were highest in the sample collected just downstream from the unnamed tributary to Stone Creek that flows from the western portion of the site.

Eighteen of the 23 TAL total metals were positively detected among the ten sediment samples (antimony, beryllium, potassium, silver, and thallium were not detected). Three inorganic analytes slightly exceeded the associated screening value including cadmium, lead, and mercury.

In summary, analytical testing of the soil samples at Site 68 detected organic compounds of each fraction. There were detections of two volatile organic compounds in the groundwater samples. Metals were detected in samples from all media. Pesticide compounds exceeded screening values in sediment samples. Inorganic analytes in each media, except surface water, exceeded either State or Federal promulgated values.

1.2.2 Regulatory Agency/Public Involvement

The USEPA and NC DENR have been actively involved with the investigation of this site through report review and partnering meetings. Based on the results no further remedial actions are recommended at this site. Public involvement is summarized in the following section.

1.3 Community Participation

A public meeting was held at MCAS, New River on August 27, 1996 to discuss the results of the Pre-RI Screening Study. The meeting included members of the local base community, and representatives from MCB, Camp Lejeune, Naval Facilities Engineering Command (LANTDIV), and Baker Environmental, Inc. The members of the project team presented the findings of the investigation and discussed the results of the risk assessment. Members of the community were given the opportunity to ask questions and comment on the related information. These comments and questions were immediately and informally addressed at the public meeting.

This document was made available to the public for comment at a public meeting held on April 19, 1998. However, there was no formal comment period. No comments have been received from the public on the draft document. Comments were received from the USEPA, NC DENR and the Navy Environmental Health Center (NEHC). These comments were incorporated into this document.

2.0 SUMMARY OF SITE CHARACTERISTICS

This section summarizes information pertaining to MCB, Camp Lejeune existing background information. In addition, specific information relevant to Site 68 is presented.

2.1 Climatology

MCB, Camp Lejeune experiences hot and humid summers; however, ocean breezes frequently produce a cooling effect. The winter months tend to be mild, with occasional brief cold spells. Average daily temperatures range from 34°F to 54°F in January, the coldest month, and 72°F to 89°F in July, the hottest month. The average yearly rainfall is 52.4 inches.

2.2 Physiography, Geology and Soils

MCB, Camp Lejeune is located in the Atlantic Coastal Plain physiographic province. The sediments of this province consist primarily of sand, silt, and clay. Other sediments may be present, including shell beds and gravel. Sediments may be of marine or continental origin. United States Geological Survey (USGS) studies at MCB, Camp Lejeuene indicate that the base is underlain by sand, silt, clay, calcareous clay and partially cemented limestone. The combined thickness of these sediments beneath the base is approximately 1,500 feet.

The surface soil at Site 68 consists of loosely packed fine grained silty sand which is dark brown to gray in color. The first foot of soil is very moist and contains a very high percentage of organic material such as roots and partially decaying leaves and twigs. The fine grained sand extends to an average depth of three feet bgs, but was found up to 17 feet bgs at one location. A noticeable color change from the dark brown to a light brown to yellow is obvious for this sand layer. A transitional layer of clayey silt with trace amounts of fine sand was found in between the sand layer and clay layer. An olive gray clay layer was encountered from 15 to 18 feet bgs. The clay layer can be classified as medium stiff and had an average thickness of two to six feet thick. Below the clay layer is another fine grained sand layer which was encountered until the test borings were advanced to their termination depths of 30 to 62 feet bgs. The sand's characteristics include a dark brown color with areas of orange staining, traces of silt and increasingly higher percentages of shell fragments downward, very wet, and with a hardness in the medium, dense range.

2.3 Hydrogeology

The aquifers of primary interest are the surficial aquifer and the underlying Castle Hayne aquifer. The surficial aquifer consists of interfingering beds of sand, clay, sandy clay, and silt that contain some peat and shells. The thickness of the surficial aquifer ranges from 0 to 73 feet and averages nearly 25 feet over MCB, Camp Lejeune. The beds are thin and discontinuous, and have limited lateral continuity. This aquifer is not used for water supply at MCB, Camp Lejeune. The Castle Hayne aquifer lies below the surficial aquifer and consists primarily of unconsolidated sand, shell fragments, and fossiliferous limestone. Between the surficial aquifer and Castle Hayne aquifer lies the Castle Hayne confining unit which consists of clay, silt, and sandy clay beds. The Castle Hayne aquifer is about 150 to 350 feet thick, increasing in thickness to the ocean. The top of the aquifer lies approximately 20 to 73 feet bgs. Onslow County and MCB, Camp Lejeune lie in an area where the Castle Hayne aquifer generally contains freshwater; therefore, the Castle Hayne aquifer is a viable potable water source for the region's population. Seven potable water supply wells exist within a one-mile radius of the study area.

At Site 68, static water level measurements of the surficial aquifer indicate that the groundwater flow is to the west across the site in a uniform direction. Static water level measurements of the Castle Hayne aquifer indicates that groundwater flows to the southwest, being slightly influenced by Stone Creek.

2.4 Surface Water

The dominant surface water feature at MCB, Camp Lejeune is the New River. It receives drainage from a majority of the base. At MCB, Camp Lejeune, the New River flows in a southerly direction into the Atlantic Ocean through the New River Inlet.

The nearest surface water body is Stone Creek which is located to the north and west of the site. At Stone Creek nearest point to the west of the site, it lies approximately 400 feet away. As shown on Figure 1-1, Stone Creek generally flows in an northwesterly direction and empties into the New River. In addition, there is an unnamed tributary which flows north into Stone Creek. The unnamed tributary lies approximately 200 feet northeast of the site boundary.

2.5 Land Use

Land use within the Base is influenced by topography and ground cover, environmental policy, and base operational requirements. Much of the land within MCB, Camp Lejeune consists of freshwater swamps that are wooded and largely unsuitable for development. In addition, 3,000 acres of sensitive estuary and other areas were set aside for the protection of threatened and endangered species and are to remain undeveloped. Operational restrictions and regulations, such as explosive quantity safety distances, impact-weighted noise thresholds, and aircraft landing and clearance zones, may also greatly constrain and influence development (LANTDIV, 1988). The combined military and civilian population of MCB, Camp Lejeune and Jacksonville area is approximately 112,000. Nearly 90 percent of the surrounding population resides within urbanized areas. The presence of MCB, Camp Lejeune has been the single greatest factor contributing to the rapid population growth of Jacksonville and adjacent communities, particularly during the period from 1940 to 1960.

2.6 Receptors

Site 68 is situated in a nonresidential area of Rife Range area that has only been used for training exercises in the past. The risk assessment recognizes this fact by preparing conceptual site models that included the following receptors:

- Current military personnel
- Future on-site residents (young child [ages 1-6 years] and adult)

The contaminants detected at the site in surface soils, subsurface soils, groundwater, surface water, and sediment can migrate from the various media in several ways, including:

- Vertical migration of contaminants from surface soil to subsurface soil.
- Leaching of contaminants from subsurface soil to water-bearing zones.
- Vertical migration from shallow water-bearing zones to deeper flow systems.
- Horizontal migration in groundwater in the direction of groundwater flow.
- Wind erosion and subsequent deposition of windblown dust.

3.0 DATA ANALYSIS/RISK ASSESSMENT

The risk assessment completed for Site 68 examined exposure pathways associated with each environmental medium and each human receptor. Pathways were evaluated both qualitatively and quantitatively, considering site conditions and associated receptors. The exposure to current military personnel and future on-site residents from soil, groundwater, surface water, and sediment was considered.

Potential exposure to surface soil may occur by incidental soil ingestion, contaminant absorption through the skin and inhalation of airborne particulates. Surface soil exposure was evaluated for current military personnel and future residential children and adults.

Subsurface soil is available for contact only during excavation activities, so potential exposure to subsurface soil is limited to current military personnel involved in training exercises and maneuvers. Potential exposure to subsurface soil may occur by incidental soil ingestion, contaminant absorbtion through the skin and inhalation of airborne particulates.

Future residents were evaluated for groundwater exposure at Site 68. At the present time, shallow groundwater in the vicinity of the site is not used as a potable supply for residents or Base personnel. The current water supply wells are set in a deeper aquifer, the Castle Hayne. However, in the future, (albeit unlikely due to poor transmissivity and insufficient flow) shallow groundwater may be tapped for potable water. Groundwater exposure was evaluated for future residential children and adults. Potential exposure pathways are ingestion, dermal contact, and inhalation of volatile contaminants while showering. However, it should be noted, that there were no VOCs detected above screening levels in the groundwater samples. Therefore, inhalation of VOCs while showering was not evaluated as an exposure pathway.

Potential exposure to surface water/sediment may occur by incidental ingestion and contaminant absorption through the skin. Future residents were evaluated for surface water/sediment exposure at Site 68.

Tables 1-1 through 1-7 presents a summary of the detected compounds and analytes at the site. The table presents the range of positive detections for each contaminant of concern. These detections were compared to USEPA COC Screening Values derived from the RBCs for residential soils and tap water as well as values stipulated by the USEPA Soil Screening Guidance, Ambient Water Quality Criteria (AWQC), Effects Range-Low (ER-L) and Effects Range-Medium (ER-M) sediment screening values.

As shown on the tables, only one detection of an organic compound, carbon disulfide, among the subsurface soil samples exceed the screening criteria. No detections of organic compounds in surface soil, groundwater, or surface water exceeded screening criteria. However, some metals detected in the surface and subsurface soil samples exceeded their respective screening criteria such as antimony, arsenic, iron, manganese, mercury, and selenium in surface soil and aluminum, arsenic, iron, manganese, and selenium in subsurface soil. The metals antimony, arsenic, iron, manganese, and thallium exceeded screening criteria in groundwater. Antimony and arsenic were only detected in the upper portion of the Castle Hayne aquifer, while iron and manganese were detected in both the surficial and the upper portion of the Castle Hayne aquifer. In surface water, iron was the only analyte to exceed AWQC. Concentrations of the organic compounds phenanthrene, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, alpha-chlordane, and gamma-chlordane exceeded sediment screening criteria. Inorganics in sediment which exceeded screening criteria included cadmium, lead, and mercury. Each of the detections were considered in the risk assessment completed for Site 68.

Those pathways and receptors identified for potential risks include the groundwater ingestion pathway for future residential children and adults. A noncarcinogenic risk is posed for children [hazard index (HI) = 14] and for adults (HI = 6) both exceeding the acceptable HI = 1.0. The noncarcinogenic risk for children is due primarily to the groundwater ingestion pathway with the primary risk drivers antimony contributing a hazard quotient (HQ) = 2.5 (62% of the elevated HI), and manganese contributing an HQ = 1.1 (28% of the elevated HI). Similarly, the risk posed for adults resulted from the groundwater ingestion pathway as well, with antimony contributing to a hazard quotient (HQ) = 1.1 and manganese contributing an HQ = 0.48 totaling approximately 90% of the elevated HI as the primary risk drivers. Antimony was detected in the upper portion of the Castle Hayne aquifer, while manganese was detected in both the surficial and upper portion of the Castle Hayne aquifers. Shallow groundwater is not currently used as a potable source at these sites, and future residential development of this site is unlikely. Based on this information, the future groundwater exposure scenario evaluated in the Risk Assessment, although highly protective of human health, is unlikely to occur.

Metals have been found to be high and often excluding Applicable or Relevant and Appropriate Requirements (ARARs) throughout MCB, Camp Lejeune. Iron and manganese are ubiquitous in all media at MCB, Camp Lejeune. These compounds often exceed ARARs and can be contaminants-of-concern for human health (manganese only). Previous studies show that concentrations of these and other metals are variable and can occur naturally in groundwater at units excluding ARARs (Greenhorne and O'Mara, 1992). Therefore, it is likely that elevated levels of metals in particular media may not be associated with waste disposal and could be ignored in risks assessments and remedial studies.

The following studies describe metals in the environment.

A study (Hem, 1992) of chemical characteristics of natural waters show that iron and manganese can occur in water through natural effects. A draft of Evaluation of Metals in Groundwater had been prepared by Baker for LANTDIV under Contract No. N62470-89-D-4814 discusses the presence of elevated metals are not always related to past disposal practices. Numerous groundwater investigations have been conducted at MCB, Camp Lejeune under the Installation Restoration Program (IRP). These studies have identified elevated levels of total metals in shallow groundwater at almost every site. And finally, Baker has performed a base-wide metals background study at MCB, Camp Lejeune in June 2000; however, the data and statistical analysis of this study will not be ready until December 2000.

4.0 DESCRIPTION OF THE NFA ALTERNATIVE

No evidence exists to suggest that the soil, groundwater, surface water, or sediment are sufficiently contaminated to pose a threat to human health. Those potential risks noted for future exposure scenarios are unlikely due to the projected groundwater use at the site. Therefore, current site conditions and environmental testing data indicated that no further action is warranted at Site 68. Even though there is no evidence to suggest that site media pose a potential health risk, land use and aquifer use controls will be enforced due to the elevated inorganics. These controls are presented in the LUCIP which is included as part of this NFA in Attachment A. The LUCIP will be enforced, through the five year review process, to ensure that elevated inorganics continue to pose no potential human health risks.

5.0 RESPONSIVENESS SUMMARY

This document was made available to the public for comment at a public meeting held on April 19, 1998. However, there was no formal comment period. No comments have been received from the public on the draft document.

6.0 REFERENCES

Baker Environmental, Inc. 1998. Final Pre-Remedial Investigation Screening Study Sites 12, 68, 75, 76, 85, and 87. Marine Corps Base, Camp Lejeune, North Carolina.

Baker Environmental, Inc. 1994. Draft Evaluation of Metals in Groundwater. Marine Corps Base, Camp Lejeune, North Carolina.

Environmental Science and Engineering, Inc. (ESE). 1990. Site Summary Report, Final, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy, Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. ESE Project No. 49-02036.

Greenhorne and O'Mara. 1992. Preliminary Draft Report Wellhead Monitoring Study. Prepared for the Department of the Navy, Civil Branch.

Hem. 1992. Study of Interpretation of the Chemical Characteristics of Natural Waters. USGS Water-Supply Paper 22254.

LANTDIV. Naval Facilities Engineering Command, Atlantic Division. January 1998. Camp Lejeune Complex Master Plan and Capital Improvements Plan Update. Prepared for the Commanding General, Marine Corps Base, Camp Lejeune, North Carolina.

TABLES

TABLE 1-1

SURFACE SOIL ORGANIC DATA
SITE 68, RIFLE RANGE DUMP
MCB, CAMP LEJEUNE, NORTH CAROLINA
NO FURTHER ACTION DECISION DOCUMENT, CTO-0120

Parameter	Contaminant Range/Frequency		Comparison to Criteria			
	Range of Positive Detections (µg/kg)	No. of Positive Detects/ No. of Samples	Region III Residential COC Screening Value[1] (µg/kg)	Positive Detects Above Residential COC Value	Soil to Groundwater Screening Level[2] (µg/kg)	Detections Above Soil to Groundwater Screening Level
Volatiles						
Acetone	12-18	3/24	780,000	0	2,810	0
Semivolatiles						
Phenol	78J	1/24	4,700,000	0	1,746	0
Di-n-butylphthalate	44J	1/24	780,000	0	24,800	0
bis(2-Ethylhexyl)phthalate	49J-160J	4/24	46,000	0	--	--
Pesticide/PCBs						
Beta-BHC	1.4J	1/24	350	0	--	--
Dieldrin	6.3NJ	1/24	40	0	40	0
4,4'-DDE	4.5J-170J	10/24	1,900	0	1,900	0
4,4'-DDT	2.3J-56J	11/24	1,900	0	1,900	0
Methoxychlor	18J	1/24	39,000	0	56,140	0
Aroclor-1260	290	1/24	320	0	--	--

Notes:

J = Estimated value
NJ = Tentative identification. Consider present.
-- = Value Not Available
COC = Contaminant of Concern
[1] USEPA Region III Risk-Based Concentrations (RBC) Table (October 1, 1998).
[2] USEPA Soil Screening Levels for Transfer from Soil to Groundwater (May, 1996)

TABLE 1-2

SURFACE SOIL INORGANIC DATA
SITE 68, RIFLE RANGE DUMP
MCB, CAMP LEJEUNE, NORTH CAROLINA
NO FURTHER ACTION DECISION DOCUMENT, CTO-0120

Analyte	Range/Frequency		Comparison to Criteria					
	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Twice the Average Base Specific Background[1] Concentration (mg/kg)	No. of Times Exceeded Twice the Average Background Concentration	Residential COC Screening Value[2] (mg/kg)	Positive Detects Above Residential COC Value	Soil to Groundwater Screening Level[5] (mg/kg)	Detections Above Soil to Groundwater Screening Level
Aluminum	1,200 - 7,460	24/24	5,856.083	4	7,800	0	--	--
Antimony	4.5J	1/24	5.455	0	3.1	1	--	--
Arsenic	0.14 - 0.87	22/24	1.322	0	0.43	11	26.6	0
Barium	3 - 28.8	24/24	17.292	7	550	0	848	0
Beryllium	0.16 - 0.59	11/24	0.205	9	16	0	--	--
Cadmium	0.44	1/24	0.696	0	7.8	0	2.72	0
Calcium+	45.8 - 8,530	23/24	1,372.977	1	--	--	--	--
Chromium	0.86 - 4.1	24/24	6.607	0	23	0	27.2	0
Cobalt	0.49 - 1.3	13/24	2.046	0	470	0	--	--
Copper	0.44 - 7.2	23/24	7.104	1	310	0	704	0
Iron+	364 - 2,990	24/24	3,702.427	0	2,300	3	151.2	24
Lead	4 - 122	24/24	23.37	1	400[3]	0	270.06	0
Magnesium+	32.4 - 213	24/24	202.96	2	--	--	--	--
Manganese	2.1 - 162	24/24	18.51	16	160	1	65.2	8
Mercury	0.05	1/24	0.094	0	2.3[4]	0	0.0154	1
Nickel	2 - 3.8	12/24	3.455	2	160	0	56.4	0
Potassium+	199	1/24	200.06	0	--	--	--	--
Selenium	0.24	1/24	0.753	0	39	0	0.223	1
Sodium+	5.7 - 34.2	12/24	59.013	0	--	--	--	--
Vanadium	1.2 - 8.2	24/24	11.447	0	55	0	--	--
Zinc	1.8 - 21	20/24	13.763	1	2,300	0	1,100.04	0

Notes:
COC = Contaminant of Concern
Shaded areas indicate analyte selected as COPC for human health risk assessment.
+ = Essential Nutrient
-- = No criteria published
J - Estimated Value
(1) Soil background concentrations are based on reference background soil samples collected from MCB Camp Lejeune investigations.
(2) USEPA Region III Risk Based Concentration (RBC) Table (October 1, 1998).
(3) Action Level for residential soils (USEPA, 1994b).
(4) Value for mercuric chloride used as a surrogate.
(5) USEPA Soil Screening Levels for Transfer from Soil to Groundwater (May, 1996).

TABLE 1-3

SUBSURFACE SOIL ORGANIC DATA
SITE 68, RIFLE RANGE DUMP
MCB, CAMP LEJEUNE, NORTH CAROLINA
NO FURTHER ACTION DECISION DOCUMENT, CTO-0120

Parameter	Contaminant Range/Frequency		Comparison to Criteria			
	Range of Positive Detections (µg/kg)	No. of Positive Detects/ No. of Samples	Region III Residential COC Value[1]	Positive Detects Above Residential COC Value	Soil to Groundwater Screening Level[2] (µg/kg)	Detections Above Soil to Groundwater Screening Level
Volatiles						
Acetone	15 - 150	7/25	780,000	0	2,810	0
Carbon Disulfide	16	1/25	780,000	0	4940	0
2-Butanone	9J	1/25	4,700,000	0	--	--
Semivolatiles						
Pyrene	48J	1/25	230,000	0	286,440	0
bis(2-Ethylhexyl)phthalate	39J - 110J	4/25	46,000	0	46,000	0
Pesticide/PCBs						
4,4'-DDT	3.4J	1/25	1,900	0	1,900	0
Aroclor-1260	12J - 26J	3/25	320	0	--	--

Notes:

J = Estimated value
COC = Contaminant of Concern
[1] USEPA Region III Risk Based Concentration (RBC) Table (October 1, 1998).
[2] USEPA Soil Screening Levels for Transfer from Soil to Groundwater (May, 1996).

TABLE 1-4

SUBSURFACE SOIL INORGANIC DATA
SITE 68, RIFLE RANGE DUMP
MCB, CAMP LEJEUNE, NORTH CAROLINA
NO FURTHER ACTION DECISION DOCUMENT, CTO-0120

Analyte	Range/Frequency		Comparison to Criteria					
	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Twice the Average Base Specific Background[1] Concentration (mg/kg)	No. of Times Exceeded Twice the Average Background Concentration	Residential COC Screening Value[2] (mg/kg)	Positive Detects Above Residential COC Value	Soil to Groundwater Screening Level[4] (µg/kg)	Detections Above Soil to Groundwater Screening Level
Aluminum	645 - 13,200	25/25	7,413.23	20	7,800	19	--	--
Arsenic	0.27 - 7.6	23/25	1.971	20	0.43	22	26.6	0
Barium	0.59 - 80.9J	25/25	14.37	13	550	0	848	0
Beryllium	0.2 - 0.87	17/25	0.191	16	16	0	--	--
Cadmium	0.56 - 0.82	3/25	0.718	1	7.8	0	2.72	0
Calcium+	16.2 - 682	25/25	387.824	5	--	--	--	--
Chromium	2 - 25.1	25/25	12.537	20	23	0	27.2	0
Cobalt	0.79 - 10.7	16/25	1.611	3	470	0	--	--
Copper	1.1 - 11.5	22/25	2.41	19	310	0	704	0
Iron+	726 - 18,600	25/25	7,134.639	16	2,300	21	151.2	25
Lead	1.1 - 11.9J	25/25	8.264	6	400[3]	0	270.06	0
Magnesium+	15.3 - 1,520	25/25	263.398	20	--	--	--	--
Manganese	3.4 - 178	24/25	7.99	20	160	1	65.2	1
Nickel	2.5 - 18.9	15/25	3.725	8	160	0	56.4	0
Potassium+	465 - 1,340	20/25	344.252	20	--	--	--	--
Selenium	0.27 - 0.53	4/25	0.806	0	39	0	0.223	4
Sodium+	12.4 - 69.2	20/25	54.57	4	--	--	--	--
Vanadium	1.7 - 33.2	25/25	13.34	20	55	0	--	--
Zinc	0.84 - 92.8	24/25	6.668	21	2,300	0	1,100.04	0

Notes:
COC = Contaminant of Concern
Shaded areas indicate analyte selected as COPC for human health risk assessment.
+ = Essential Nutrient
-- = No criteria published
J - Estimated Value
(1) Soil background concentrations are based on reference background soil samples collected from MCB Camp Lejeune investigations.
(2) USEPA Region III Risk Based Concentration Table (October 1, 1998).
(3) Action Level for residential soils (USEPA, 1994b).
(4) USEPA Soil Screening Levels for Soil to Groundwater (May, 1996).

TABLE 1-5

GROUNDWATER ORGANIC AND INORGANIC DATA
SITE 68, RIFLE RANGE DUMP
MCB, CAMP LEJEUNE, NORTH CAROLINA
NO FURTHER ACTION DECISION DOCUMENT, CTO-0120

Parameter	Groundwater Criteria					Frequency/Range		Comparison to Criteria				
	NCWQS[1] (µg/L)	MCL[2] (µg/L)	Region III Tapwater COC Screening Value[3] (µg/L)	Federal Health Advisories[4] (µg/L)		No. of Positive Detects/ No. of Samples	Concentration Range (µg/L)	No. of Detects Above NCWQS	No. of Detects Above MCL	No. of Detects Above COC Value	No. of Detects Above Health Advisories	
				10 kg Child	70 kg Adult						10 kg Child	70 kg Adult
Volatiles												
Carbon Disulfide	NE	NE	100	NE	NE	2/9	4J - 4J	NA	NA	0	NA	NA
2-Hexanone	NE	NE	150	NE	NE	1/9	6J	NA	NA	0	NA	NA
Inorganics												
Aluminum	NE	50/200[5]	3,700	NE	NE	8/18	186J -3,690	NA	8/7	0	NA	NA
Antimony	NE	6	1.5	10	15	2/18	20.3 - 21	NA	2	2	2	2
Arsenic	50	50	0.045	NE	NE	1/18	0.96	0	0	1	NA	NA
Barium	2,000	2,000	260	NE	NE	18/18	3.6 - 50.9	0	0	0	NA	NA
Beryllium	NE	4	7.3	4,000	20,000	1/18	4.2J	NA	1	0	0	0
Cadmium	5	5	1.8	5	20	1/18	4.8	0	0	1	0	0
Calcium+	NE	NE	NE	NE	NE	18/18	1,890-109,000	NA	NA	NA	NA	NA
Chromium	50	100	11	200	800	3/18	3.5 - 5.9J	0	0	0	0	0
Cobalt	NE	NE	220	NE	NE	4/18	3.1 - 35.8J	NA	NA	0	NA	NA
Copper	1,000	1,300[6]	150	NE	NE	13/18	2.3 - 25.6	0	0	0	NA	NA
Iron	300	300[5]	1,100	NE	NE	17/18	16.4 - 6,170	5	5	4	NA	NA
Lead	15	15[6]	NE	NE	NE	6/18	0.84 - 2.9J	0	0	NA	NA	NA
Magnesium+	NE	NE	NE	NE	NE	18/18	334 - 8,850	NA	NA	NA	NA	NA
Manganese	50	50[5]	73	NE	NE	16/18	2.6J - 1,390	6	6	2	NA	NA
Mercury	1.1	2	1.1[7]	NE	2	2/18	0.031J - 0.035J	0	0	0	NA	0
Nickel	100	100	73	500	1,700	4/18	9.2J-65.4	0	0	0	0	0
Potassium+	NE	NE	NE	NE	NE	14/18	1,040J - 15,000	NA	NA	NA	NA	NA

TABLE 1-5 cont'd.

GROUNDWATER ORGANIC AND INORGANIC DATA
SITE 68, RIFLE RANGE DUMP
MCB, CAMP LEJEUNE, NORTH CAROLINA
NO FURTHER ACTION DECISION DOCUMENT, CTO-0120

Parameter	Groundwater Criteria					Frequency/Range		Comparison to Criteria				
	NCWQS[1] (µg/L)	MCL[2] (µg/L)	Region III Tapwater COC Screening Value[3] (µg/L)	Federal Health Advisories[4] (µg/L)		No. of Positive Detects/ No. of Samples	Concentration Range (µg/L)	No. of Detects Above NCWQS	No. of Detects Above MCL	No. of Detects Above COC Value	No. of Detects Above Health Advisories	
				10 kg Child	70 kg Adult						10 kg Child	70 kg Adult
Selenium	50	50	18	NE	NE	1/18	2.1	0	0	0	NA	NA
Sodium+	NE	NE	NE	NE	NE	18/18	1,880 - 46,200	NA	NA	NA	NA	NA
Thallium	NE	2	0.26	7	20	6/18	3.6J - 6.6J	NA	6	6	0	0
Vanadium	NE	NE	26	NE	NE	6/18	2.8 - 23.1J	NA	NA	0	NA	NA
Zinc	2,100	5,000[5]	1,100	3,000	10,000	10/18	4 - 250	0	0	0	0	0

Notes:

Shaded areas indicate parameter selected as COPC.
(1) NC WQS = North Carolina Water Quality Standards for Groundwater (15A NCAC2L)
(2) MCL = Safe Drinking Water Act Maximum Contaminant Level
(3) USEPA Region III RBC Table (October 1, 1998).
(4) Longer Term Health Advisories for a 10 kg Child and 70 kg Adult
(5) SMCL = Secondary Maximum Contaminant Level
(6) Action Level for drinking water.
(7) Value for mercuric chloride used as a surrogate.
(8) USEPA Soil Screening Levels for Soil To Groundwater (May 1996).
+ - Essential Nutrient
NE - No Criteria Established
NA - Not Applicable
J - Estimated Value
COC - Contaminant of Concer

TABLE 1-6

SURFACE WATER ORGANIC AND INORGANIC DATA
SITE 68, RIFLE RANGE DUMP
MCB, CAMP LEJEUNE, NORTH CAROLINA
NO FURTHER ACTION DECISION DOCUMENT, CTO-0120

Parameter	Surface Water Criteria			Contaminant Frequency/Range		Comparison to Criteria		
	NCWQS[1] (µg/L)	Federal Health AWQCs[2]		No. of Positive Detects/ No. of Samples	Contaminant Range (µg/L)	Positive Detects Above NCWQS	Positive Detects Above AWQC	
		Water & Organisms (µg/L)	Organisms Only (µg/L)				Water & Organisms	Organisms Only
Semivolatiles								
Di-n-butylphthalate	2,700	2,700	12,000	1/10	1J	0	0	0
Inorganics								
Aluminum	NE	NE	NE	10/10	141 - 422	NA	NA	NA
Barium	1,000	1,000	NE	10/10	11.3 - 18.4	0	0	NA
Cadmium	NE	NE	NE	1/10	2.9	NE	NE	NE
Calcium+	NE	NE	NE	10/10	6,530 - 27,300	NA	NA	NA
Iron	NE	300	NE	10/10	410 - 594	NA	10	NA
Lead	NE	50	NE	6/10	0.87 - 2.5	NA	0	NA
Magnesium+	NE	NE	NE	10/10	1,260 - 25,500	NA	NA	NA
Manganese	200	50	100	10/10	11.7 - 42.5	0	0	0
Potassium+	NE	NE	NE	6/10	865 - 8,030	NA	NA	NA
Selenium	NE	NE	NE	1/10	1.7	NA	NA	NA
Sodium+	NE	NE	NE	10/10	6,650 - 210,000	NA	NA	NA
Vanadium	NE	NE	NE	1/10	2.4	NA	NA	NA
Zinc	NE	NE	NE	2/10	4.1 - 4.2	NA	NA	NA

Notes:

Shaded areas indicate parameter selected as COPC for human health risk assessment.

(1) NC WQS = North Carolina Water Quality Standards for Surface Water

(2) AWQC = Ambient Water Quality Criteria

\+ = Essential Nutrients

NE = Not Established

NA = Not Applicable

J = Estimated value

TABLE 1-7

SEDIMENT ORGANIC AND INORGANIC DATA
SITE 68, RIFLE RANGE DUMP
MCB, CAMP LEJEUNE, NORTH CAROLINA
NO FURTHER ACTION DECISION DOCUMENT, CTO-0120

Parameter	Sediment Screening Values[1]		Range/Frequency		Comparison to Criteria	
					Positive Detects Above	
	ER-L Concentration	ER-M Concentration	Range of Positive Detections	No. of Positive Detects/ No. of Samples	ER-L	ER-M
Semivolatiles (µg/kg)						
Phenanthrene	240	1,500	280J	1/10	1	0
Anthracene	85.3	1,100	62J	1/10	0	0
Fluoranthene	600	5,100	420J	1/10	0	0
Pyrene	665	2,600	330J	1/10	0	0
Benzo(a)anthracene	261	1,600	190J	1/10	0	0
Chrysene	384	2,800	210J	1/10	0	0
Bis(2-ethylhexyl)phthalate	NE	NE	250J	1/10	NA	NA
Benzo(b)fluoranthene	NE	NE	250J	1/10	NA	NA
Benzo(k)fluoranthene	NE	NE	97J	1/10	NA	NA
Benzo(a)pyrene	430	1,600	170J - 380J	3/10	0	0
Indeno(1,2,3-cd)pyrene	NE	NE	110J	1/10	NA	NA
Benzo(g,h,i)perylene	NE	NE	98J	1/10	NA	NA
Pesticides/PCBs (µg/kg)						
4,4'-DDE	2.2	27	6.7 - 550	9/10	9	5
4,4'-DDD	1.58[2]	46.1[2]	2.5J - 2,900	9/10	9	4
4,4'-DDT	1.58[2]	46.1[2]	6.3J - 4,500	7/10	7	3
Alpha-chlordane	0.5[3]	6[3]	13J	1/10	1	1
Gamma-chlordane	0.5[3]	6[3]	14NJ	1/10	1	1
Inorganics (mg/kg)						
Aluminum	NE	NE	351 - 11,500	10/10	NA	NA
Arsenic	8.2	70	0.64J - 4.2	5/10	0	0
Barium	NE	NE	1.5 - 28.1	10/10	NA	NA
Cadmium	1.2	9.6	0.5 - 4.7	3/10	2	0
Calcium+	NE	NE	71.3 - 11,900	10/10	NA	NA
Chromium	81	370	0.79 - 12.6	10/10	0	0
Cobalt	NE	NE	0.75 - 6.3	5/10	NA	NA
Copper	34	270	0.45 - 14.9	8/10	0	0
Iron	NE	NE	296 - 16,300	10/10	NA	NA
Lead	46.7	218	1.8 - 73J	10/10	1	0

TABLE 1-7 cont'd

SEDIMENT ORGANIC AND INORGANIC DATA
SITE 68, RIFLE RANGE DUMP
MCB, CAMP LEJEUNE, NORTH CAROLINA
NO FURTHER ACTION DECISION DOCUMENT, CTO-0120

Parameter	Sediment Screening Values[1]		Range/Frequency		Comparison to Criteria	
					Positive Detects Above	
	ER-L Concentration	ER-M Concentration	Range of Positive Detections	No. of Positive Detects/ No. of Samples	ER-L	ER-M
Magnesium+	NE	NE	23.5 - 8,330	10/10	NA	NA
Manganese	NE	NE	2.7 - 127	10/10	NA	NA
Mercury	0.15	0.71	0.4	1/10	1	0
Nickel	20.9	51.6	2.3 - 9.7	3/10	0	0
Selenium	NE	NE	0.79 - 1.2	2/10	NA	NA
Sodium+	NE	NE	55.8 - 15,400	7/10	NA	NA
Vanadium	NE	NE	0.7 - 26.6	10/10	NA	NA
Zinc	150	410	3.8 - 86.5	9/10	0	0

Notes:

Shaded areas indicate parameter selected as COPC for human health risk assessment.
ER-L - Effects Range-Low
ER-M - Effects Range-Medium
(1) Long et al., 1995.
(2) Value for total DDT
(3) Region IV National Oceanic and Atmospheric Administration (NOAA) sediment screening value
+ = Essential Nutrients
NA - Not Applicable
NE - Not Established
J - Estimated value

FIGURES

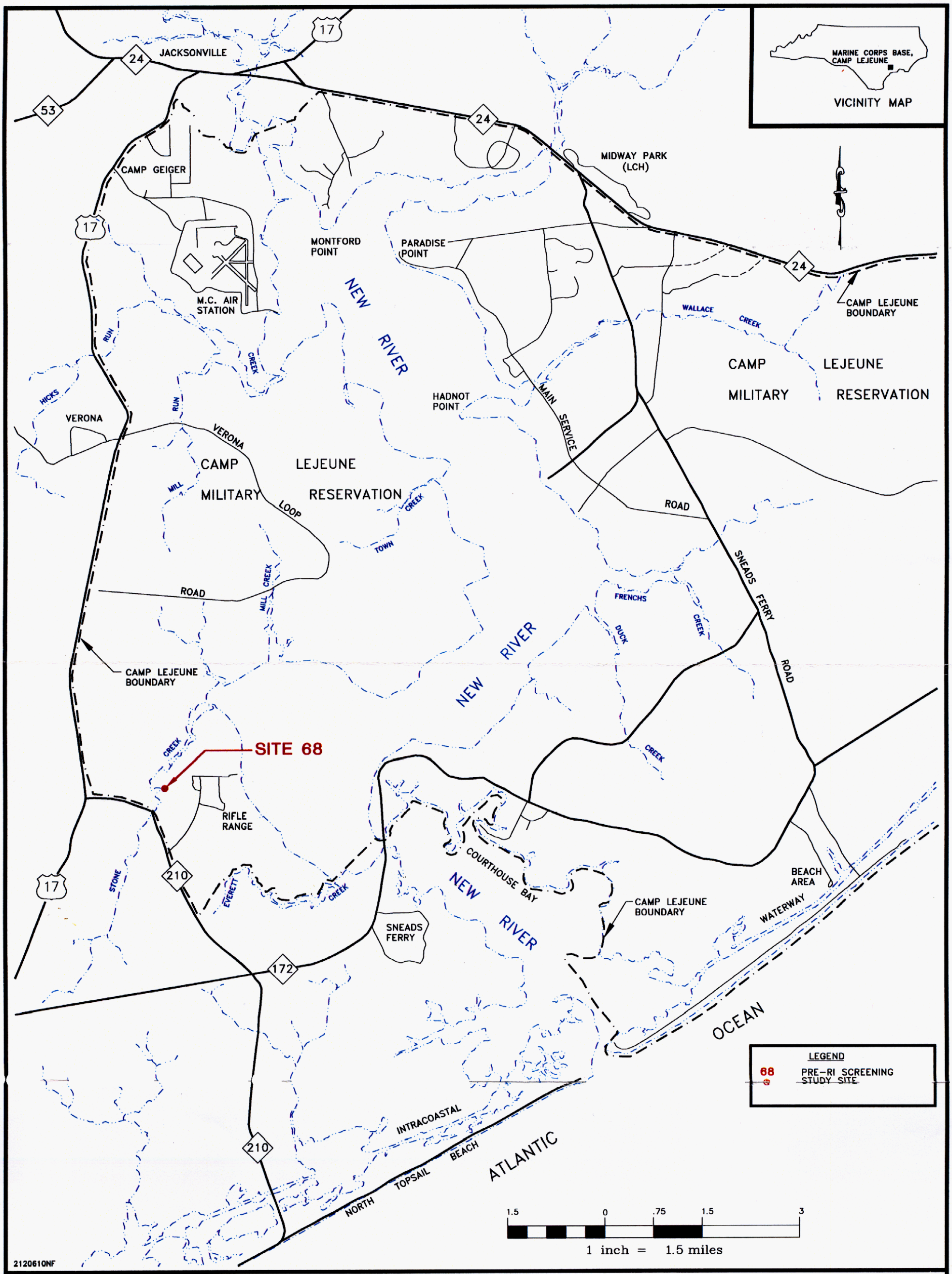
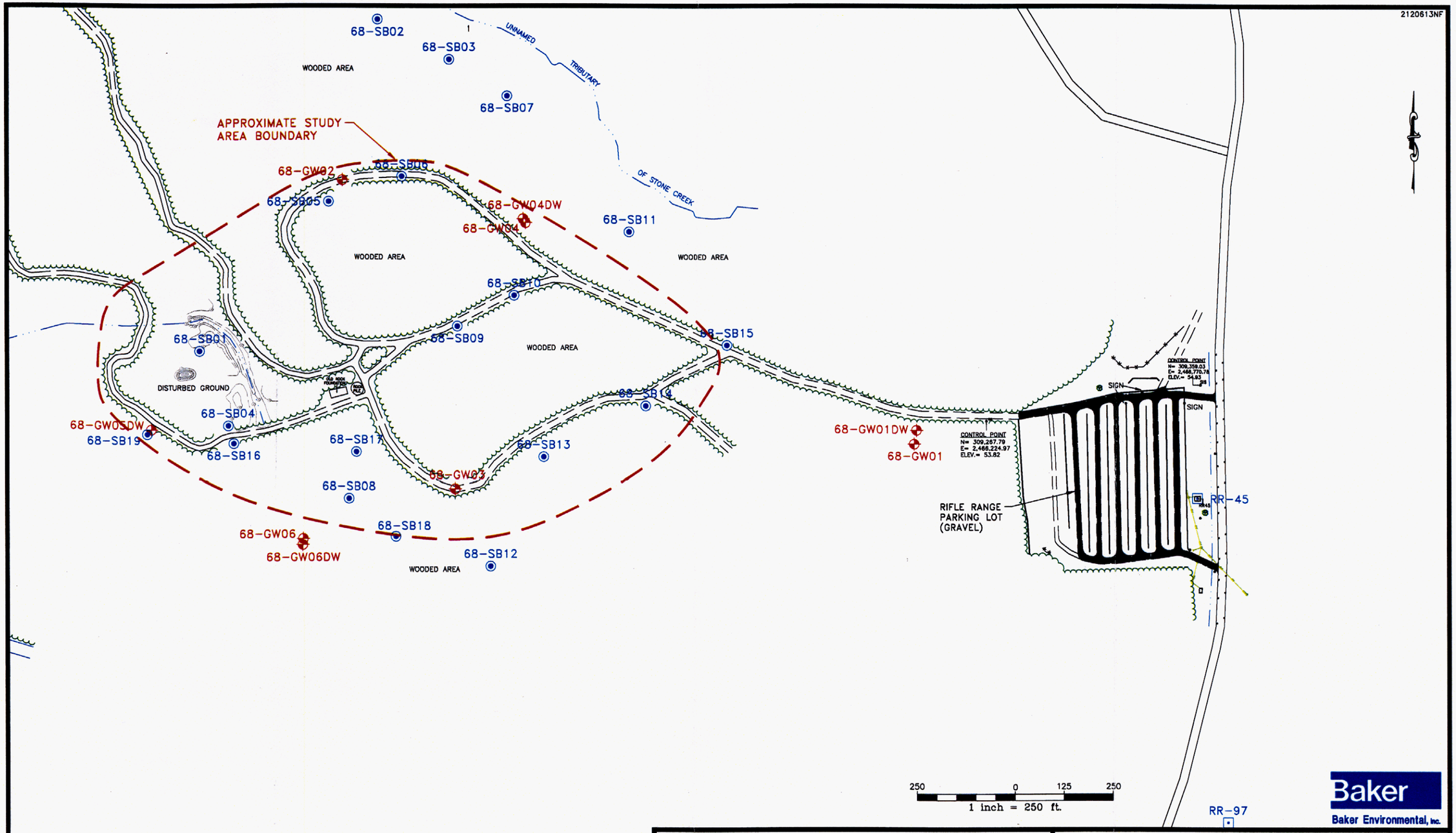


FIGURE 1-1
SITE LOCATION MAP
NO FURTHER ACTION DECISION DOCUMENT
CTO - 0120

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

0259 DRV

2120613NF



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LEGEND

68-GW01DW – EXISTING GROUNDWATER MONITORING WELL LOCATION

68-SB12 – SOIL BORING LOCATION

RR-97 – SUPPLY WELL LOCATION

– TREE LINE

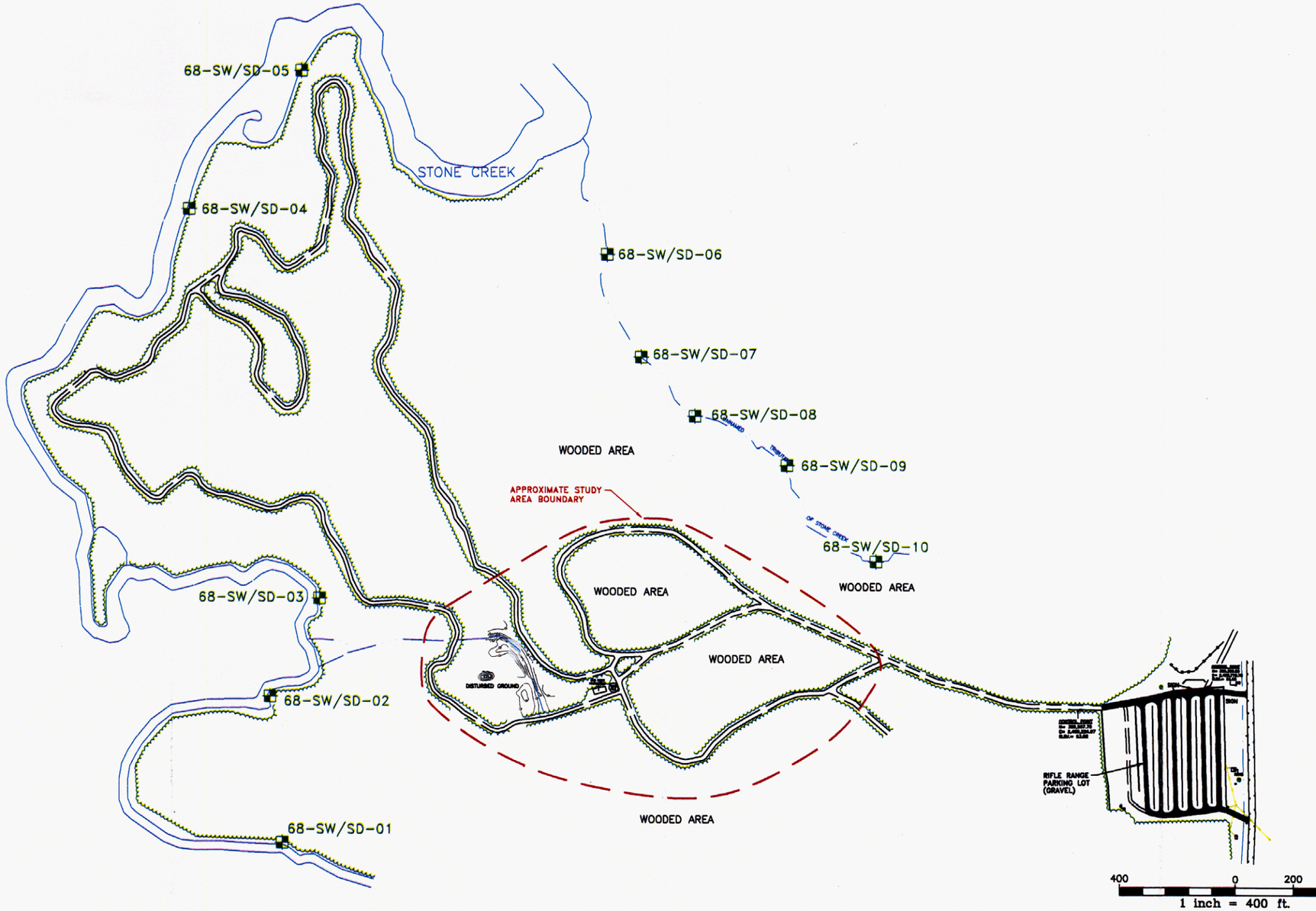
– INTERMITTENT STREAM

– DIRT OR GRAVEL ROAD

SOURCE: BRENT A. LANIER R.L.S., FEBRUARY 1996.

FIGURE 1-2
SOIL AND GROUNDWATER
SAMPLE LOCATIONS
SITE 68 – RIFLE RANGE AREA
NO FURTHER ACTION DECISION DOCUMENT
CTO – 0120
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

2120611NF



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LEGEND

68-SW/SD-04 – SURFACE WATER AND SEDIMENT SAMPLE STATION

– TREE LINE

– INTERMITTENT STREAM

– DIRT OR GRAVEL ROAD

SOURCE: BRENT A. LANIER R.L.S., FEBRUARY 1996.

FIGURE 1-3
SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS
SITE 68 – RIFLE RANGE AREA
NO FURTHER ACTION DECISION DOCUMENT
CTO – 0120
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

ATTACHMENT A
LAND USE CONTROL
IMPLEMENTATION PLAN (LUCIP)

Original LUCIP Date: November 1999
Last Revised: September 2000

LAND USE CONTROL IMPLEMENTATION PLAN (LUCIP)
MCB CAMP LEJEUNE (SITE 68)
RIFLE RANGE DUMP

GENERAL

By separate Memorandum of Agreement dated May 24, 1999, hereinafter referred to as the Land Use Control Assurance Plan (LUCAP), the U.S. Environmental Protection Agency (USEPA); the North Carolina Department of Environment and Natural Resources (NC DENR); and the Department of the Navy (DON) on behalf of U.S. Marine Corps Base (MCB), Camp Lejeune, agreed that the DON and the United States Marine Corps (Marine Corps) shall follow certain procedures for implementing and maintaining site-specific land use controls. Those procedures are contained in the LUCAP, and, for Site 68, this Land Use Control Implementation Plan (LUCIP). The LUCAP is intended to ensure that all of the DONs site-specific selected remedies with land use controls remain protective of human health and the environment. This LUCIP and its requirements are part of the Final No Further Action (NFA) for Site 68.

The parties to the LUCAP also agree that the efficacy/protectiveness of the land use controls within this LUCIP is contingent upon the DONs substantial good-faith compliance with those procedures applicable to the NFA and the LUCIP for Site 68. Should such compliance not occur or should the LUCAP be terminated, the parties agree that the protectiveness of the LUCIP may be reconsidered by any party and remedial measures may be necessary to ensure the protection of human health and the environment. Based upon the history of Site 68, the need for remedial action would be determined and implemented through the five year review process.

This document is the LUCIP for MCB Camp Lejeune, Site 68, Rifle Range Dump. This LUCIP is an attachment to and a part of the NFA for the site.

The DON and the Marine Corps will, pursuant to the LUCAP, include the land use controls set forth in this LUCIP within the Installation's Geographic Information System (GIS) and the base master planning process. Pursuant to the LUCAP paragraph IV. a)., the Installation will provide written notification to the State and USEPA when the requirements of this paragraph have been met.

All proposed changes to this LUCIP will be submitted to the State and USEPA for review and concurrence prior to implementation. Changes to this LUCIP will be reflected in changes under the five year review plan.

The parties agree that the DONs annual certification of land use control implementation is necessary for as long as the DON retains ownership of the site. The NC DENR maintains this annual certification is part of the selected remedy. The DON and Marine Corps maintain this annual certification is a procedure to implement the selected remedy and is not a part of the selected remedy. Nevertheless, all parties agree that a written certification is desirable. Accordingly, pursuant to the LUCAP paragraph V. b)., MCB Camp Lejeune will provide certification annually to USEPA and the NC DENR that the land use controls within the NFA remain implemented.

SITE BOUNDARY IDENTIFICATION

The geographic boundary of the site is identified in Figure 1, Boundary of Site 68. This boundary indicates the outermost border of all controlled portions of the site (i.e., no areas subject to land use controls lie outside this boundary). The current boundary is driven by aquifer use controls.

The geographic boundary of the current groundwater contamination is identified in Figure 2, Boundary of Current Shallow Groundwater Contamination. The geographic boundary of the current deep groundwater contamination is identified in Figure 3, Boundary of Current Deep Groundwater Contamination. The geographic boundary of the current soil contamination is identified in Figure 4, Boundary of Current Soil Contamination.

SITE USE CONTROLS

Unless specifically excepted by both NC DENR and USEPA, all residential land uses at the site are prohibited (see Figure 5, Boundary of Land Use Controls). These controls are to remain in effect until it can be demonstrated that the elevated inorganics do not pose a potential risk to human health. This would be determined through the five year review process.

AQUIFER USE CONTROLS

Except for monitoring purposes or as specifically excepted by NC DENR or the USEPA, all use of groundwater beneath Site 68 is prohibited. In addition, the installation of any well, other than those constructed for monitoring purposes, is prohibited except as authorized by North Carolina Administrative Code Title 15A, Chapter 2C (as amended), Well Construction (see Figure 6, Boundary of Aquifer Use Controls). A 1,000-foot buffer around boundary of potential shallow and deep groundwater contamination is used to delineate this boundary. These controls are to remain in effect until it can be demonstrated that the elevated inorganics do not pose a potential risk to human health. This would be determined through the five year review process.

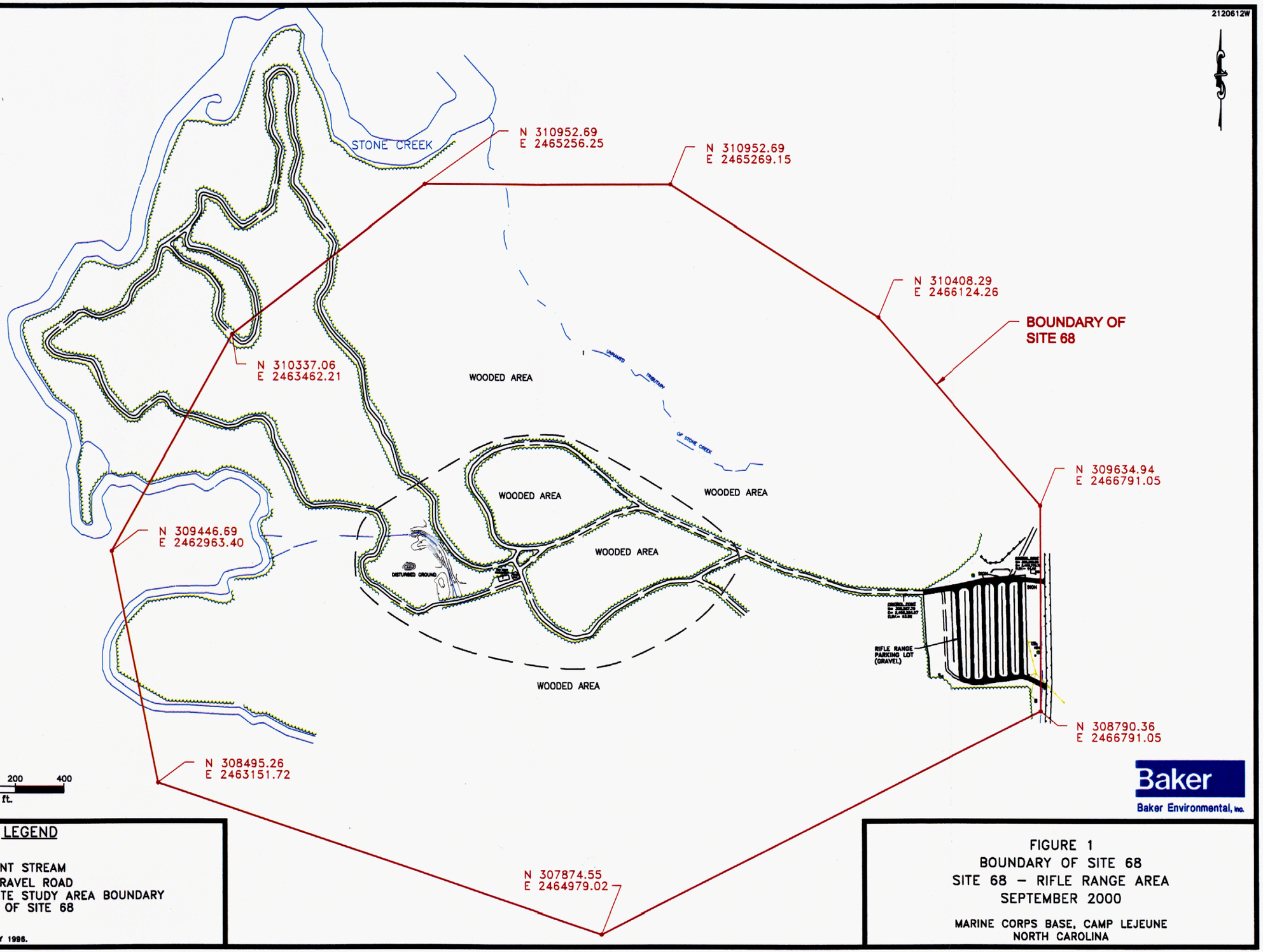
SITE ACCESS CONTROLS

There are no controls on site access.

NOTIFICATION

Following the procedures contained within the LUCAP, MCB Camp Lejeune shall file a Notification of Inactive Hazardous Substance or Waste Disposal Site meeting the requirements of NCGS 130A-310.8.

2120612W



LEGEND

- TREE LINE
- INTERMITTENT STREAM
- DIRT OR GRAVEL ROAD
- APPROXIMATE STUDY AREA BOUNDARY
- BOUNDARY OF SITE 68

SOURCE: BRENT A. LANIER R.L.S., FEBRUARY 1996.

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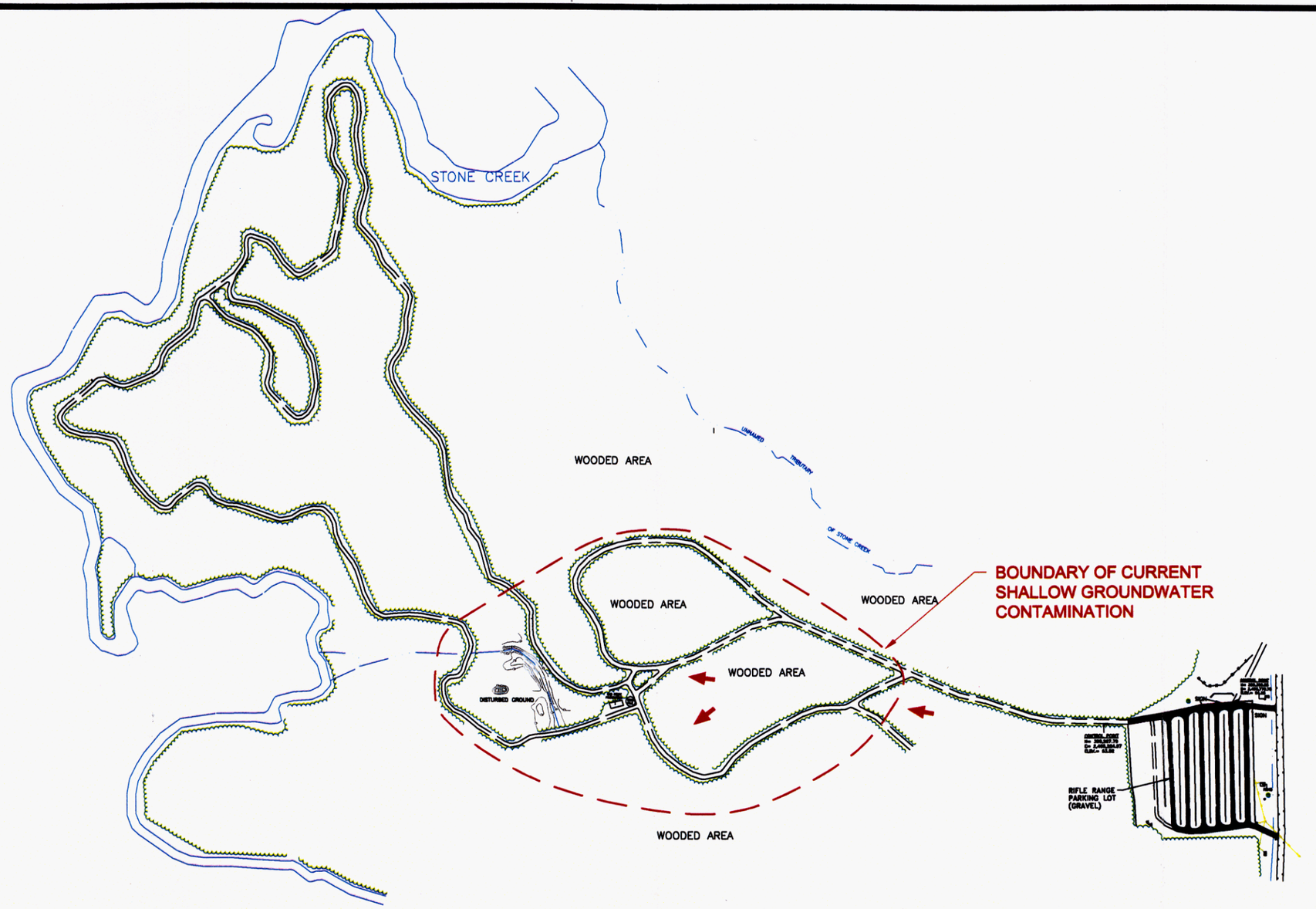
FIGURE 1
BOUNDARY OF SITE 68
SITE 68 – RIFLE RANGE AREA
SEPTEMBER 2000

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

02592DB2V

2120613W



400 0 200 400
1 inch = 400 ft.

LEGEND

- TREE LINE
- INTERMITTENT STREAM
- DIRT OR GRAVEL ROAD
- BOUNDARY OF CURRENT SHALLOW GROUNDWATER CONTAMINATION
- GROUNDWATER FLOW DIRECTION

SOURCE: BRENT A. LANIER R.L.S., FEBRUARY 1998.

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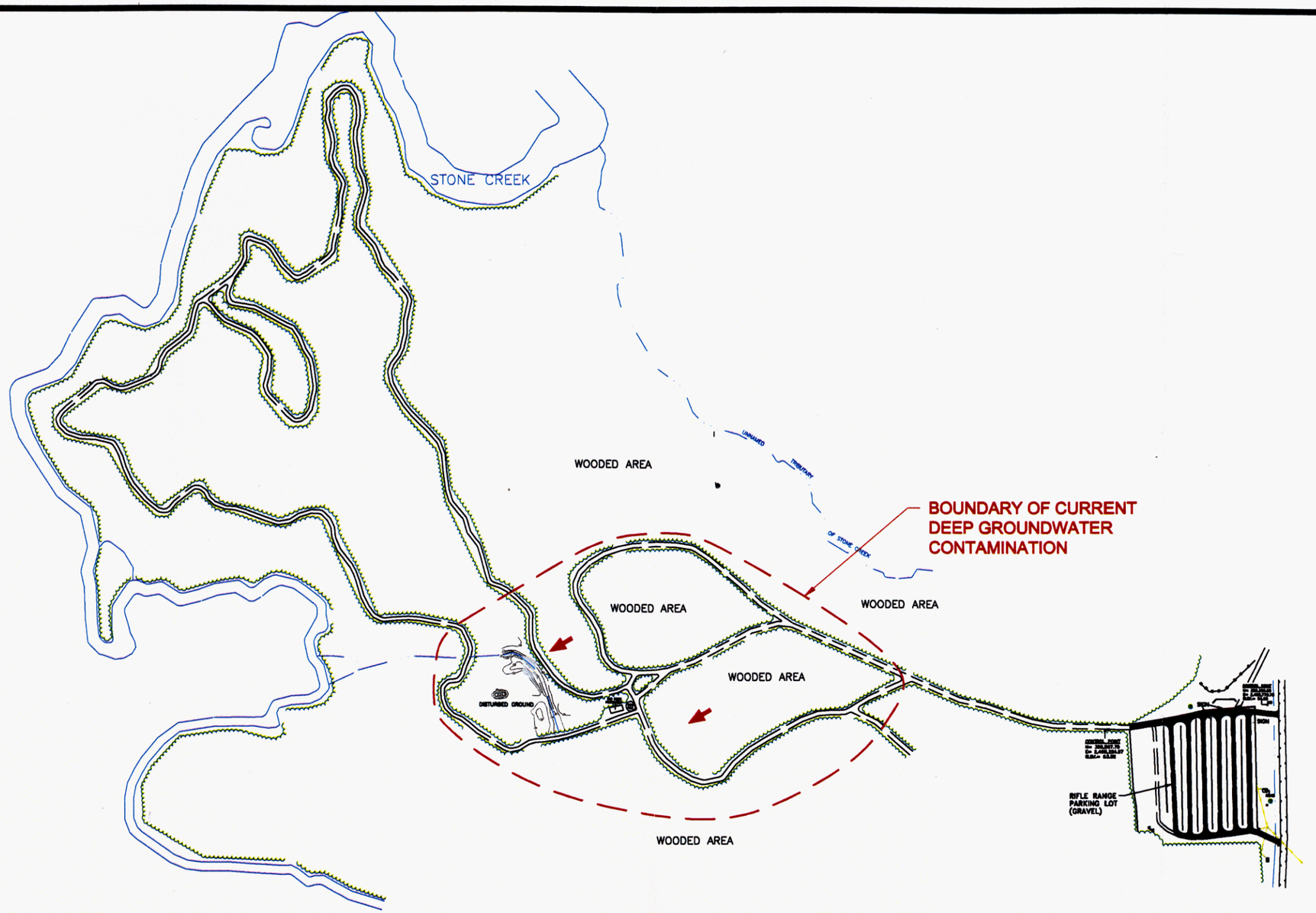
FIGURE 2
BOUNDARY OF CURRENT
SHALLOW GROUNDWATER CONTAMINATION
SITE 68 – RIFLE RANGE AREA
SEPTEMBER 2000
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

2120614W



400 0 200 400
1 inch = 400 ft.

LEGEND

- TREE LINE
- INTERMITTENT STREAM
- DIRT OR GRAVEL ROAD
- BOUNDARY OF CURRENT DEEP GROUNDWATER CONTAMINATION
- GROUNDWATER FLOW DIRECTION

SOURCE: BRENT A. LANIER R.L.S., FEBRUARY 1998.

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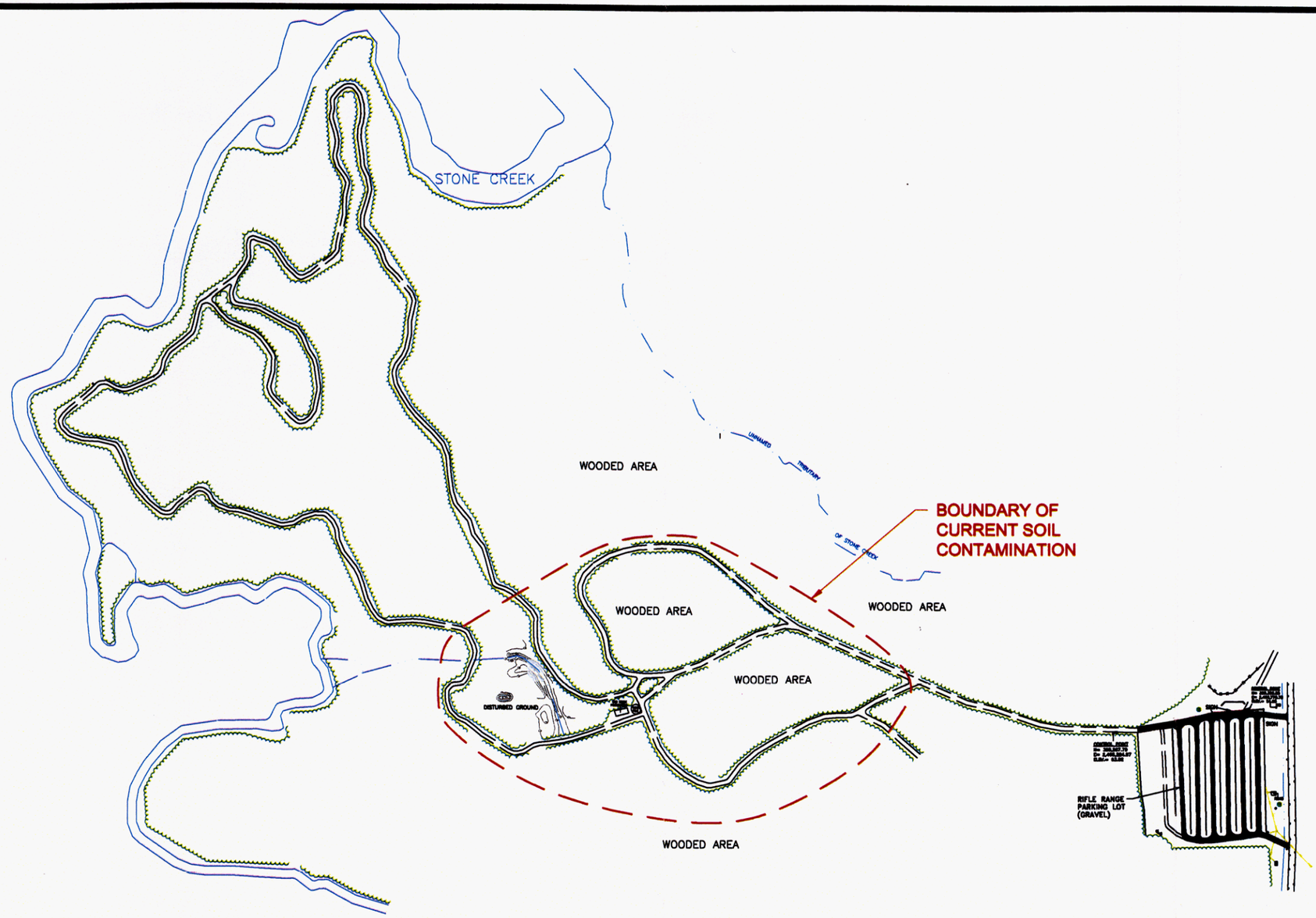
FIGURE 3
BOUNDARY OF CURRENT
DEEP GROUNDWATER CONTAMINATION
SITE 68 – RIFLE RANGE AREA
SEPTEMBER 2000
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

2120615W



400 0 200 400
1 inch = 400 ft.

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LEGEND

- TREE LINE
- INTERMITTENT STREAM
- DIRT OR GRAVEL ROAD
- BOUNDARY OF CURRENT SOIL CONTAMINATION

SOURCE: BRENT A. LANIER R.L.S., FEBRUARY 1998.

FIGURE 4
BOUNDARY OF CURRENT
SOIL CONTAMINATION
SITE 68 – RIFLE RANGE AREA
SEPTEMBER 2000
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

2120616W

STONE CREEK

UNNAMED TRIBUTARY OF STONE CREEK

WOODED AREA

N 309934.62
E 2464561.45

N 309934.62
E 2464842.92

BOUNDARY OF LAND USE CONTROLS

WOODED AREA

WOODED AREA

N 309546.60
E 2465532.81

N 309577.86
E 2463958.02

DISTURBED GROUND

N 309274.44
E 2465569.60

RIFLE RANGE PARKING LOT (GRAVEL)

N 309182.49
E 2463958.02

WOODED AREA

N 308875.39
E 2464920.19

400 0 200 400
1 inch = 400 ft.

LEGEND

- TREE LINE
- INTERMITTENT STREAM
- DIRT OR GRAVEL ROAD
- BOUNDARY OF LAND USE CONTROLS

SOURCE: BRENT A. LANIER R.L.S., FEBRUARY 1996.

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FIGURE 5
BOUNDARY OF LAND
USE CONTROLS
SITE 68 – RIFLE RANGE AREA
SEPTEMBER 2000
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

2120617W

STONE CREEK

N 310952.69
E 2465256.25

N 310952.69
E 2465269.15

N 310408.29
E 2466124.26

BOUNDARY OF AQUIFER
USE CONTROLS

N 310337.06
E 2463462.21

WOODED AREA

UNNAMED TRIBUTARY OF STONE CREEK

WOODED AREA

WOODED AREA

WOODED AREA

N 309634.94
E 2466791.05

N 309446.69
E 2462963.40

DISTURBED GROUND

RIFLE RANGE PARKING LOT (GRAVEL)

WOODED AREA

N 308790.36
E 2466791.05

N 308495.26
E 2463151.72

N 307874.55
E 2464979.02

400 0 200 400
1 inch = 400 ft.

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LEGEND

- TREE LINE
- INTERMITTENT STREAM
- DIRT OR GRAVEL ROAD
- APPROXIMATE STUDY AREA BOUNDARY
- BOUNDARY OF AQUIFER USE CONTROLS

SOURCE: BRENT A. LANIER R.L.S., FEBRUARY 1998.

FIGURE 6
BOUNDARY OF AQUIFER USE CONTROLS
SITE 68 – RIFLE RANGE AREA
SEPTEMBER 2000

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA